Our black hole

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ABSTRACT

Using simple formula, we aim to show why our universe should be a black hole. We consequently suggest that black holes have precisely a Schwarzschild's radius and not less, and that the speed of light and the speed of expansion of our universe are the same quantities.

We also suggest that the notion of observable universe is not correct. All the matter belonging to our universe should be visible as the expansion of the universe would have never gone faster than the speed of light.

LIST OF ACRONYMS USED IN THIS DOCUMENT

Acronym	Description	Formula	Value (SI)
c	Speed of light as defined today	-	$3{,}00.\,10^{8}\mathrm{m.s^{-1}}$
G	Gravitational constant as defined today	-	$6{,}67.\,10^{-11}\mathrm{m^{3}.s^{-2}.kg^{-1}}$
H	Hubble's constant	-	$2{,}30.\,10^{-18}s^{-1}$
t_H	Hubble's time/Age of the universe	$\frac{1}{\mathrm{H}}$	$4{,}35.\,10^{17}\mathrm{s}$
r_H	Hubble's radius	$\frac{\mathrm{c}}{\mathrm{H}}$	$1{,}30.\,10^{26}\mathrm{m}$
V_H	Hubble's volume	$\frac{4\mathrm{r_H}^{3}}{3}$	$9{,}20.\,10^{78}\mathrm{m^{3}}$
ρ_C	Critical density of the universe	$\frac{3c^2H^2}{8\pi G}$	$8{,}52.\,10^{-10}J.m^{-3}$
E_H	Hubble's energy	$V_H.\rho_C$	$7{,}84.\,10^{69}J$
m_H	Hubble's mass	$\frac{E_H}{c^2}$	$8{,}71.\,10^{52}kg$

As a reminder, we have the total density of the universe ρ defined by Friedmann's equations:

$$\rho = \frac{3c^2\left(H^2 + \frac{Kc^2}{a^2}\right)}{8\pi G}$$

Where $\frac{K}{a^2}$ is the expression of the curvature of the universe. In a flat universe, we have:

$$\rho = \rho_C$$

INTRODUCTION

For years many articles pointed the possibility of having our universe inside a black hole or having born from a black hole [1] [2] [3].

Other articles have talked about the possibility of modified theories such as MOND to explain black matter, acceleration of expansion speed and black energy [4] [5] [6] [7] [8] [9]. We will here use concepts that have already been mentioned in various articles but we will link them together to have a coherent description of our universe.

The main idea of this document is to make things simple. Human beings have always been able to invent complicated models to make them fit observations. But often, solutions are much simpler than expected. We will here try to use the simplest models suggested by the observation.

I. OUR UNIVERSE IS A BLACK HOLE

If we consider a flat universe defined by Hubble's parameters (time, radius, volume and mass) that has the same speed of light as the one we know in our universe and that we will call Hubble's universe, we get:

- a universe with precisely the properties of a black hole
- a universe with the properties of our universe

Indeed our universe fits at least some of them: time, mass and probably the flatness (according to the last results, it should be either flat or almost flat). The radius and the volume can still be discussed but we will see in the next paragraph that our universe should also fit these two last criteria.

I.A. EXPLANATION 1

Let us calculate the escape velocity of the Hubble's universe, v_{escape}. By definition, we have:

$$v_{escape} = \sqrt{\frac{2Gm_H}{r_H}}$$

We know that:

$$m_H = \frac{E_H}{c^2}$$

$$E_H = V_H . \rho_C$$

This gives:

$$m_H = \frac{V_H . \rho_C}{c^2} = \frac{\frac{4\pi {r_H}^3}{3} . \frac{3c^2H^2}{8\pi G}}{c^2}$$

$$m_H = \frac{{r_H}^3 . c^2 . H^2}{c^2 . 2G} = \frac{{r_H}^3 . H^2}{2G}$$

Then we get:

$$v_{escape} = \sqrt{\frac{2G}{r_H} \cdot \frac{{r_H}^3 . H^2}{2G}}$$

$$v_{escape} = \sqrt{{r_H}^2 . H^2}$$

$$v_{escape} = r_H . H$$

$$v_{escape} = c$$

I.B. EXPLANATION 2

Let's apply the formula of the Schwarzschild's radius to Hubble's universe:

$$R_{Schwarzschild} = \frac{2Gm_H}{c^2}$$

$$R_{Schwarzschild} = \frac{2G}{c^2} \cdot \frac{{r_H}^3 . H^2}{2G} = \frac{{r_H}^3}{{r_H}^2} = r_H$$

$$R_{Schwarzschild} = r_H$$

I.C. INTERPRETATION

To say that Hubble's universe is a black hole means that objects that will go out of this universe will need to go faster than light. If we assume that this is possible, it will anyway not be possible to see them from inside this universe as they will disappear as soon as they will go faster than light.

This is why any visible object in Hubble's universe cannot go faster than light and the maximum speed in Hubble's universe is the speed of light.

Noticing that our so-called visible universe fits most of the properties of Hubble's universe (radius, age) and seems to fit the others (mass, flatness), we will continue to work in this document assuming that our visible universe is a Hubble's universe, which means that our visible universe is a black hole.

We will also use all Hubble's properties as the properties of our universe (H, r_H, E_H, m_H).

II. ALL BLACK HOLES ARE OTHER UNIVERSES

Having noticed that our visible universe is a black hole because light cannot go out of our universe, we can assume that any black hole is actually another universe. We already know that it has a mass, a size, etc. This is a quite acceptable assumption if we admit the previous part.

III. THE SCHWARZSCHILD'S RADIUS IS THE MINIMUM RADIUS OF ANY OBJECT

If the previous paragraphs are correct, this gives the information that a black hole has to have exactly a radius corresponding to the Schwarzschild's radius. In the theory, it is said that any object having a radius smaller than the Schwarzschild's radius is a black hole. But in reality, it cannot be smaller. It has to be exactly the same.

Indeed, having a black hole with a radius smaller than Schwarzschild's radius would mean that the escape velocity is higher than the light speed. This would mean that objects inside the black hole could be invisible for observers inside the black hole and outside the black hole. These objects would not move fast enough to go out of the black hole, but would not move slow enough to be visible from inside the black hole. These objects would be lost. And we assume the possibility of having objects not visible by anyone as incoherent.

Considering a black hole as an object, we then get the result that no object can have a radius smaller than the Schwarzschild's radius. The Schwarzschild's radius is the minimal radius of any matter. If an object had a smaller radius, some of its matter would be neither visible by an observable inside the object by an observer outside.

IV. EVERYTHING IS VISIBLE IN OUR UNIVERSE

What has just been written means that we should not talk about visible universe anymore. There is no "observable universe" or "non observable universe". Everything that is contained in our universe is visible.

Nothing can get out of a black hole or pass through its borders which are exactly at the cosmological horizon. Everything has to be contained between us and the cosmological horizon. This means that our entire universe is observable or visible.

V. THE SPEED OF LIGHT IS NECESSARILY EQUAL TO THE SPEED OF EXPANSION OF THE UNIVERSE

This hypothesis is not so spread but it helps understanding the universe. There is an article written by Alastair Macleod [10] that gives first analysis on this possibility.

There are different ways of thinking of it:

1. Admitting that our entire universe is visible, the cosmic microwave background has to be at its limits as it is the first light of our universe.
2. We also know that:
- the highest speed of any visible object is the speed of light, which means that the light for the cosmic microwave background cannot arrive to us faster than with the speed of light.
- the lowest speed of these rays is also the speed of light. Otherwise, we would not be able to see the cosmic microwave background, the first light of the universe. It would not have arrived to us. The cosmic microwave background is the furthest shining object, and this object has to go away from the limits of the universe at the speed of light
3. Moreover:
- if we imagine our universe expanding faster than light, we get a lot of difficulties of explanations that many astronomers are nowadays facing
- if we imagine our universe expanding slower than light, either our universe is getting new matter (coming from other universes around ours?) and becoming heavier and heavier, or our universe is getting new empty space and we would see in the sky a lot of empty space behind the cosmic microwave background, which is not the case.

The consequences are numerous, but let us mention the two first main consequences:

1. There has to be a unique and identical speed and unique and identical notion for both. We can forget about a speed of expansion, and think only of a speed of light, or the contrary.
2. Everything is always visible; the cosmic microwave background will always look the same and stay at the same distance equal to:

$$r_H(t) = c.t$$

This formula means that the ratio between the radius of the universe and c is changing proportionally to the time. This is actually a differential equation that we can write:

$$r_H(t) = \dot{r_H}(t).t$$

Solving it gives immediately the same formula but confirms that c is constant over time:

$$r_H(t) = c.t$$

VI. EXPLANATION FOR THE ACCELERATION OF THE EXPANSION OF THE UNIVERSE

If we agree with the fact that our universe is expanding at the speed of light, we have to find an explanation to the observed redshift of far supernovae, the hypothetic acceleration of the expansion of the universe and the black energy [11].

Indeed this hypothesis does not fit what we have just suggested; otherwise c would not be constant anymore and would be accelerating over time.

Different works have proposed other interpretations that would keep c as a constant. Some are invoking gravitational redshifts [12], effects of inhomogeneities [13], or quintessence [14], etc [15].

We currently work on other hypothesis.

CONCLUSION AND CONSEQUENCES

Our universe is a black hole. The big bang, or the start of our universe is just the death of a heavy star. This means that our universe is surrounded by another one, and that all the black holes that we observe in our universe are hosting other universes.

The visible universe is actually our universe. The invisible universe is what is outside of our universe.

The CMB is the first light of our universe. It means that it will always look the same as seen from anywhere in the universe.

Time, mass, distance, temperature, entropy, etc. correspond to the same thing. They are all proportional. Time is going by. The radius of our universe is increasing with a speed proportional to the time, like the speed of light. The speed of light is nothing more than:

$$c = \frac{r_{Universe}}{t_{Universe}}$$

But as $r_{Universe}$ and $t_{Universe}$ are proportional, c looks constant. Everything depends on the reference one chooses.

The mass of our universe is then increasing over time, like the mass of any black hole, with a speed proportional to the time. As time is running by, matter from outside our universe is attracted in our black hole.

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